

# The Navy's Role in the Development Of Radio Communications

*Excerpts from speeches by RAdm. H.C. Bruton, Director of Naval Communications, and Capt. E.W. Taylor, Commanding Officer, U.S. Naval Communication Station, Washington, at the decommissioning of U.S. Naval Radio Station Arlington, on 14 July 1956.*

On 30 June 1956, the shutting off of power to the operating equipment of Radio Arlington brought to an end the services of the Navy's first high-power radio station.

Referred to at various times as Radio Virginia, Radio Arlington, Radio Washington, or, simply by its call letters NAA, it was known and respected by communications personnel, military and civilian, throughout the world.

## Major Role

Ordinarily, the closing of a naval activity as the result of its becoming obsolete would attract little interest. However, Radio Arlington has been of too great significance for its deactivation to pass without comment. Its history, from commissioning to deactivation, marks the period during which not only naval radio communications, but much of the art of radio communications itself was developed and fostered.

During this period Radio Arlington and the personnel associated with it played a major role in the research, evaluation, and improvement of equipments and techniques that make possible the nearly miraculous high-speed radio circuits of today.

As early as 1899, the Navy became interested in the possibility of using radio for rapid communications between the Fleet and the shore establishment. By 1909, tests and plans had been completed and the Navy purchased its first high-power transmitter—a 100-kilowatt synchronous rotary spark—for installation at "Radio Virginia."

On 13 February 1913, the Navy's first radio station was placed in commission and assigned the call letters NAA. This call became

familiar to radio operators throughout the world.

The new station rapidly exceeded the expectations of its designers. Transmissions over distances undreamed of were soon found to be practicable. The success resulted in demands for more powerful equipment. The demands led to the development and use of new types of transmitters—first, the arc converter and a short time later the vacuum tube transmitter.

The first vacuum tube transmitter, replacing the 100-kilowatt spark set, was a 6-kilowatt equipment. With the advent of the water-cooled tube, transmitters operated in the intermediate and high frequency bands with a power output up to 20 kilowatts, a very high power for that day. The first of each of these types was installed at Arlington.

Throughout the ensuing years, Arlington continued to be a proving ground for new radio equipment.

During its first year or two the station was used primarily for

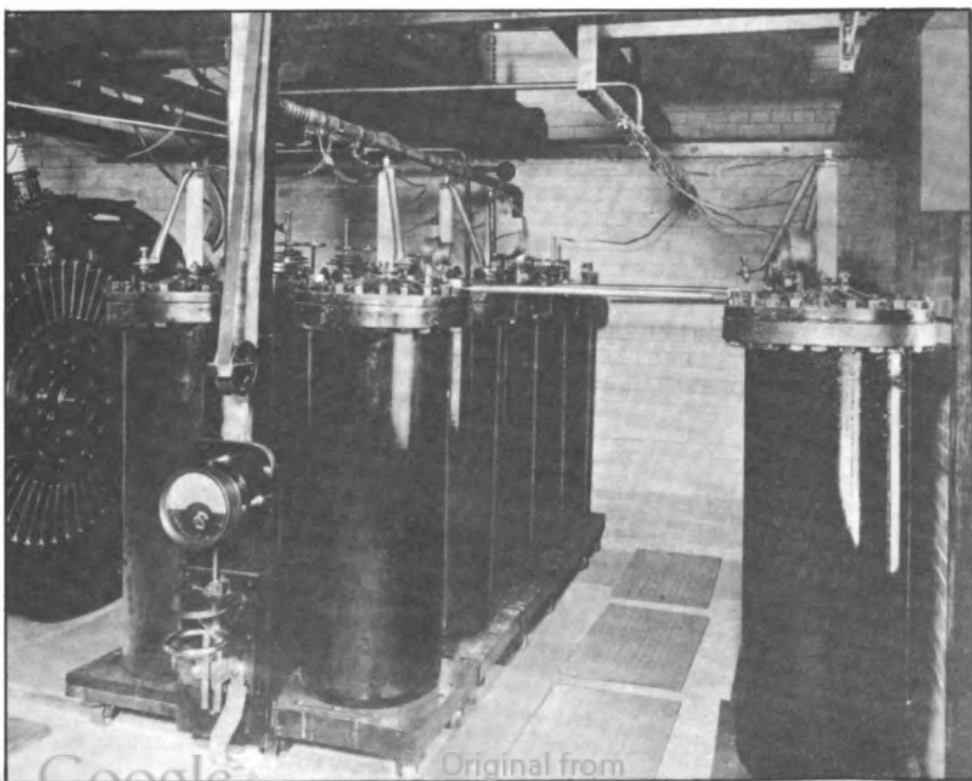
shore-to-ship and shore station-to-shore station transmissions. Later, through improvements in receiving equipment, ship-to-shore service was inaugurated. During this period, many of the now common services rendered by the Naval Communication Station Washington were started at Arlington.

## Continuous Contact

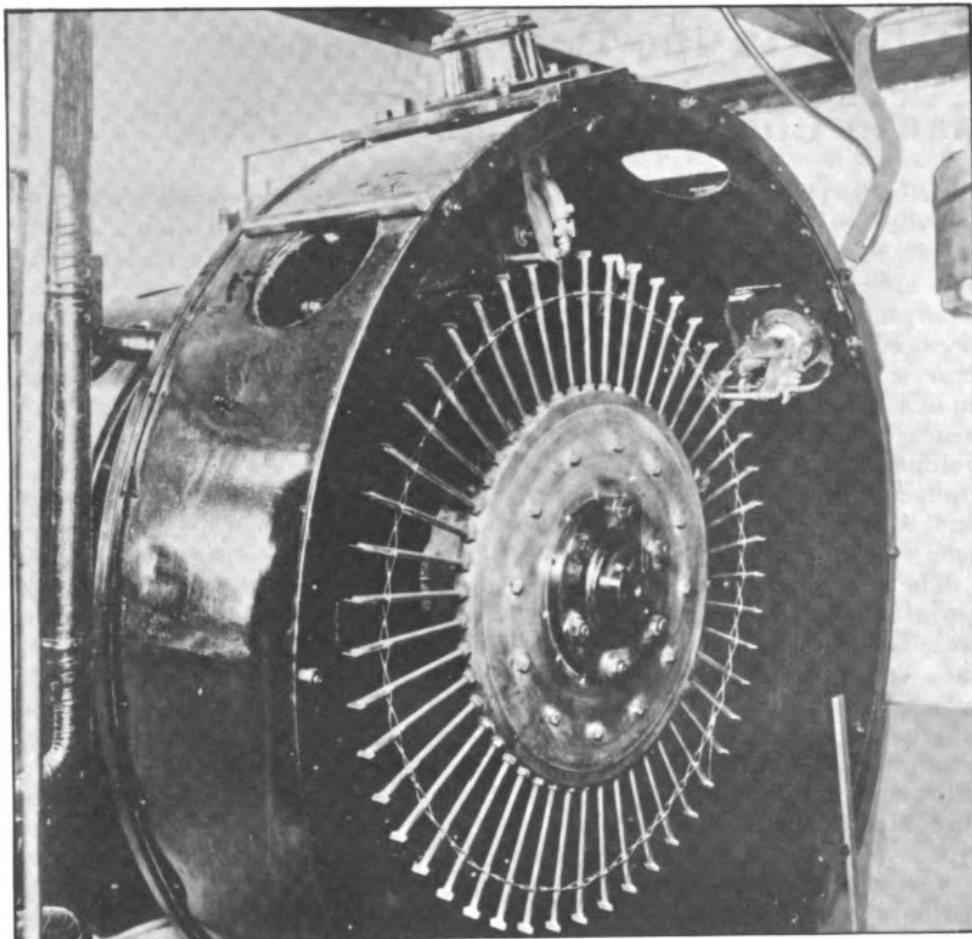
Messages were delivered to ships in the Atlantic and Caribbean areas. The signals from Radio Arlington were heard as far away as Europe and Honolulu. Such service enabled the President for the first time to be in continuous contact with the State Department and the White House while he was on extended cruises.

Time signals and weather forecasts were broadcast. The latter services rapidly became popular not only with ships at sea but also with jewelers, watchmakers, and farmers. So dependent did these groups become on the services that when the signals were not trans-

High-power spark transmitter installed at Radio Arlington in 1913.







Synchronous gap for the 100-kilowatt spark transmitter.

mitted as scheduled, their complaints were more numerous than the complaints from the units at sea for whom the transmissions were intended.

The historic commissioning of Radio Arlington in 1913 and its decommissioning in 1956 are but two significant events in the story of the Navy's contributions to the development of radio communications. **Navy Firsts**

Not only the Navy, but all the services as well as private industry have made outstanding contributions to the development of radio communications. However, the field of radio communications is large and only a very few developments are mentioned here.

As the Navy's contribution is closely related to Radio Arlington, a few Navy firsts will be recalled.

Just before the turn of the century, the U.S. Navy invited Dr. Guglielmo Marconi to apply his new wireless telegraph system to the USS *New York*, the USS *Massachusetts*, and the USS *Porter*.

Out of sight of one another and separated by 36 miles of ocean, these ships actually communicated. Two years later, in 1901, the Navy outfitted all of its major ships with German-made communications equipment, the best to be had at the time.

Even during those early days, the Navy rapidly became a leader in adopting the new art. From 1904 to 1908, for example, half of the 387 wireless stations in the entire world were operated by U.S. naval personnel. By 1908 the Navy had established the U.S. Naval Radio Laboratory, to conduct scientific radio research.

During the same year, when President Theodore Roosevelt sent the Great White Fleet around the world on an international goodwill mission, Dr. Lee De Forest, the "father of radio broadcasting," was on board the battleship *Connecticut*, flagship of the Fleet.

Dr. De Forest, using equipment that had the new vacuum tubes, supervised one of the first suc-

cessful tests of the wireless telephone between the *Connecticut* and the Naval Radio Station at Point Loma, Calif., and "radio broadcasting," the transmission of voice by radio, was in part being born.

Airborne radio communications equipment, now taken for granted in all commercial and military aircraft, was being developed by the Navy as early as 1911 and 1912.

#### Radiotelephone

The first experimental radiotelephone transmitter was installed at Arlington in 1915 for communication with the Eiffel Tower, Paris, France, and was heard at the Naval Radio Station Guam in August, as well as in Mare Island, Honolulu, and Paris.

A Navy enlisted man was the first to point out the influence of "sunspots" on radio communications. That the sunspot cycle vitally affects radio communications (particularly long-range communications) is now well-known and accepted.

In 1916, the world's first remotely controlled radio station was installed and operated by the U.S. Navy in Washington. This station was in the old State, War, and Navy Department Building on Pennsylvania Avenue at Seventeenth Street, N.W.

Before World War I ended, the Navy had in operation the largest radio network in the world. The Navy radio communications system not only handled the messages for the U.S. naval forces on the seas, but also those between the War Department and the American Expeditionary Forces in France.

#### Radio Beacon

In 1917 the Navy developed the radio beacon and made the first installation at Point Judith, R.I., as a radiophone fog-warning device.

In 1919, the Navy was successfully transmitting radio voice communications from air to ground and ground to air. A year later, radio voice communications were successfully exchanged by the Navy between a flying aircraft and a submerged submarine.

The Navy's broadcasting station at Anacostia—call NOF—later located at NAA, was the first broadcasting station in the Nation's



capital and, except for very early experiments by Lee De Forest, was one of the very first broadcasting stations in the United States. As early as 1920, the Navy's Anacostia Station broadcast music from recordings and received requests from listeners in 28 states—good coverage even today.

In 1922, the Navy was the first to detect a moving ship by radio waves, a forerunner of our modern radar.

Today many of the news pictures in the press have been transmitted by radiophoto techniques that the Navy calls radio facsimile, a by-product of radio.

In the early 1920's personnel of the Navy were already investigating and testing facsimile equipment. In 1923, recognizable pictures of President Harding were transmitted by the Navy from Washington to Philadelphia.

In 1945, 22 years later, photographs of the Japanese surrender aboard the USS *Missouri* were transmitted more than 5,000 miles to the United States and the Nation's press.

#### Control of Aircraft

Today, weather maps and other pictorial data are transmitted thousands of miles for the benefit of both the Navy and the public.

The Navy was the first to broadcast the voice of a President of the United States, that of Warren G. Harding, during the dedication of the Lincoln Memorial.

Radio control of aircraft by naval personnel was first successful in the United States in 1923. The guided missiles of today have been evolved from such beginnings.

As early as 1924, the Navy transmitted the first regular daylight transcontinental communications on high frequencies.

Another byproduct of the Navy's role in radio communications has been its pioneering and development of radar.

The powerful radio station at Jim Creek Valley in the state of Washington, is an example of the fulfillment of the Navy's pioneer efforts in VLF. The naval radio stations at Arlington, Va., and at Annapolis, Md., 30 miles distant, were established in part to test

and evaluate various types of radio equipment, including VLF.

A chain of high-power, long-wave stations began with Radio Arlington. The Navy installed stations with certain modifications of equipment at Colon and Darien, C.Z., Pearl Harbor, T.H., San Diego, Calif., Cavite, P.I., San Francisco, and Annapolis. The original chain was completed in 1918.

#### Station NFF

During the winter of 1918, the Navy installed a 200-kilowatt alternator at its New Brunswick, N.J., station--NFF. This station then became the most powerful transmitting station in the world. Field receivers on the battlefield in France could hear it, as did naval ships in all parts of the world.

After the Armistice, the Navy constructed a high-power station near Bordeaux, France--Radio Lafayette. Radio Lafayette was

the world's first 1,000-kilowatt long-wave radio station when it was completed in 1920.

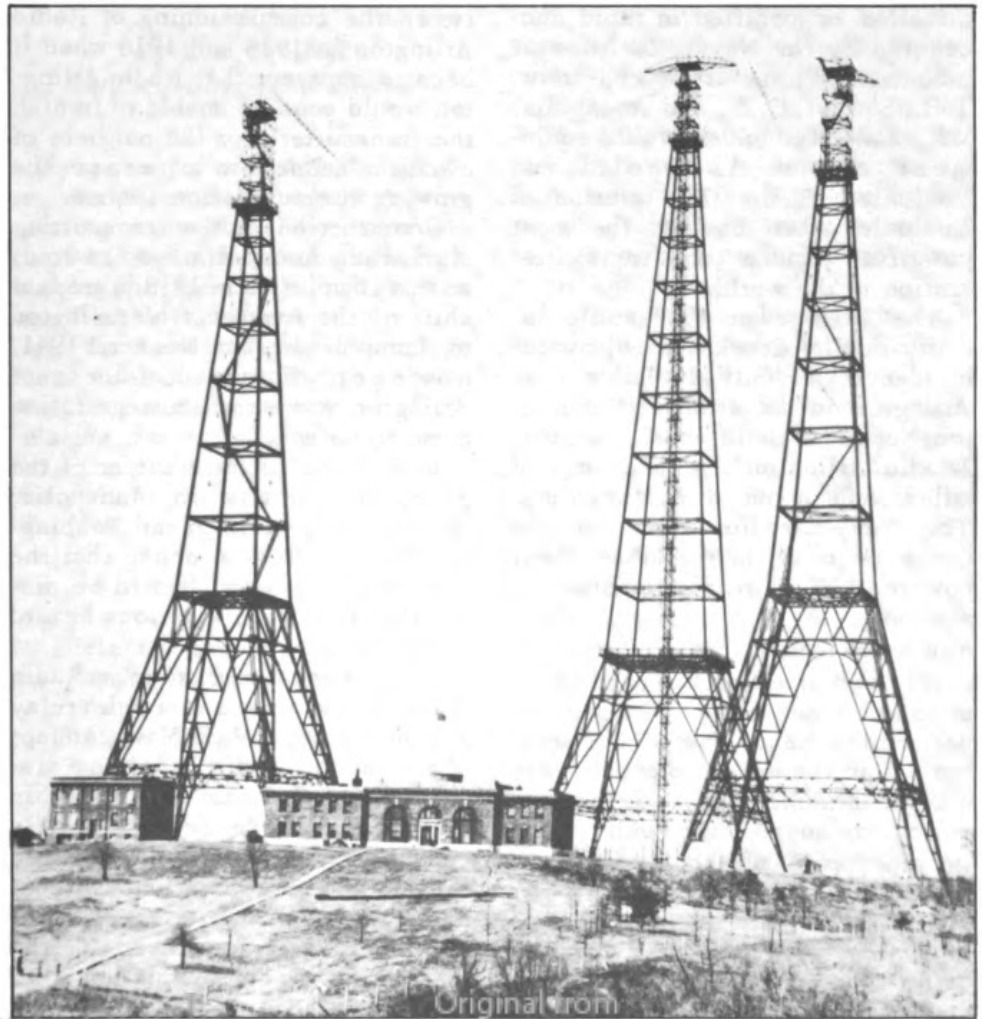
The Navy's Radio Lafayette Station together with a similar installation of two 360-kilowatt arcs at Radio Annapolis maintained the reliability of trans-Atlantic communications for the troops of the occupation of the American Expeditionary Forces of World War I.

In 1926, the new vacuum tube transmitter in operation at Navy Radio San Diego made obsolete previous arc and spark transmitters. In 1949, this transmitter too was retired as obsolete.

#### Cavite Station

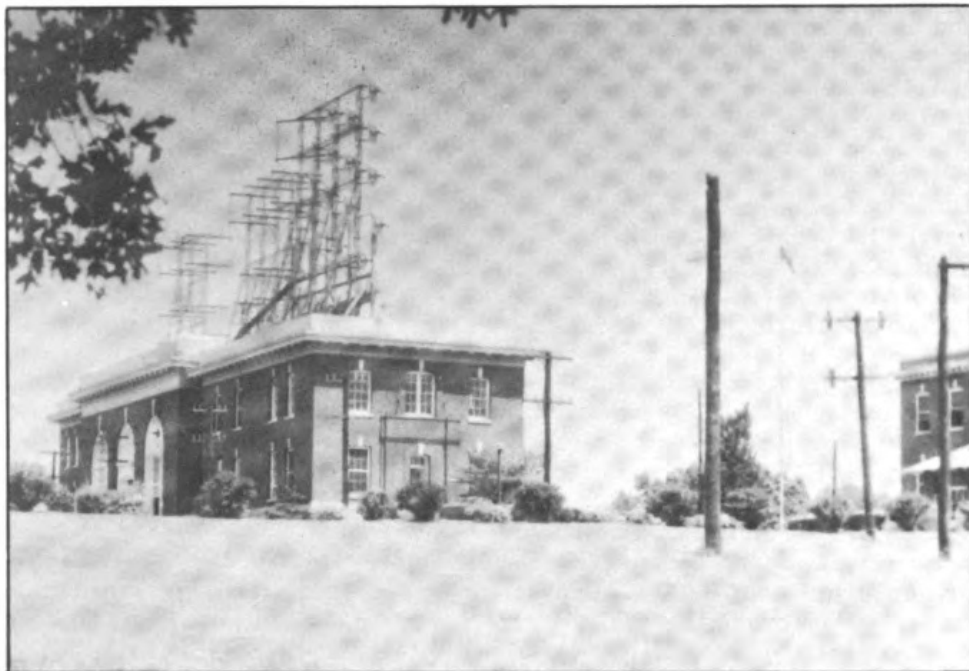
Meanwhile, in 1932, the Cavite naval radio station in the Philippine Islands, that was to become famous in December 1941 when the Japanese attacked American forces, was modified by the installation of a 300-kilowatt electron tube trans-

Early view of the three towers of Radio Arlington that became a hazard to aircraft in the Washington area.



Original from  
UNIVERSITY OF CALIFORNIA





After its towers were dismantled, Radio Arlington was used as a radio relay station.

mitter which replaced the former arc transmitter.

Additional VLF stations were installed or modified in rapid succession by the Navy--300-kilowatt tube transmitters at Pearl Harbor, T.H., Summit, C.Z., and Annapolis, Md., and later 500-kilowatt equipment at both Annapolis and Lualualei, T.H. The station at Lualualei then became the most powerful vacuum tube transmitter station in the world.

The high-power VLF radio facility at Jim Creek Valley, by coincidence, is only 11 miles from Arlington in the state of Washington, but separated from the original "Radio Arlington" by thousands of miles and about a half century. The Navy's radio station at Jim Creek is today the world's highest powered VLF radio transmitting station.

#### New Maine Station

But the Jim Creek station is soon to be surpassed by its counterpart on the East Coast. The latest project in the development of Navy VLF communications that are required to support the widely dispersed forces of the Navy is the construction of an even higher powered VLF station in the state of Maine, for the North Atlantic better-than-equal twin of its Pacific counterpart.

Soon the North Atlantic station, not yet commissioned, may be surpassed. Only 3 years elapsed between the commissioning of Radio Arlington in 1913 and 1916 when it became apparent that Radio Arlington would soon be unable to furnish the transmitters for the numbers of circuits needed to operate the growing communication system.

Construction of the transmitting station at Annapolis was started, and on completion in 1918, a gradual shift of the functions of Arlington to Annapolis began. Not until 1941, however, did the usefulness of Arlington as a transmitter station come to an end.

In addition to the transfer of the Arlington circuits to Annapolis, the aircraft pattern in the Washington area became so dense that the towers at Arlington had to be dismantled to remove a serious hazard to airplanes.

After removal of its towers, Radio Arlington was used as a radio relay station between Main Navy, Annapolis, and the radio receiving station at Cheltenham, Md. Within the past year, further changes in equipment design made it desirable to link the three stations without using Arlington.

Consequently, any need for the station, from a communication point of view ceased.

Therefore, the Chief of Naval Operations recommended that the station be deactivated on 1 July 1956. The Secretary of the Navy approved the recommendation, and on 30 June 1956 the Navy's first radio station completed its long and profitable service.

Excerpts from a few of the messages received at the decommissioning of Radio Arlington follow:

For years this station was the pride and joy of the Navy men who pioneered in radio. The 43 ensuing years since its establishment have seen this station install, test, and evaluate prototypes of today's modern high-speed equipment. Many of the practices and techniques of radio communications, commonplace today, were developed at Arlington.

Radio Arlington was the cradle of the Navy's modern communications system; its closing brings to an end a communication activity that has been a landmark in Navy communications.--RAdm. David M. Tyree, Commandant of Potomac River Naval Command.

As a radio pioneer from 1900, I have witnessed and taken active part in the grand development of American wireless communications in this land and over the seven seas.

I observed with keenest personal interest the first trans-Atlantic-telephone messages from NAA to the Eiffel Tower, Paris, and to Honolulu, because in that work the three-electrode tube was first used for real radio power.

I deeply regret that this historic radio station must now be decommissioned by the Navy which has always been my faithful ally through the early development of radio communications.--Dr. Lee De Forest.

When Radio Arlington went on the air in 1912, it marked the opening of a new era in radio communications. Powerful signals radiated from Radio Arlington established Arlington as truly a pioneer "Voice of America" and put the Navy in the forefront in communications.

The lofty towers overlooking the Potomac offered unique opportunity for many radio experiments that led

to remarkable advances in wireless telegraphy as well as radio telephony.--David Sarnoff, Chairman of the Board of the Radio Corporation of America.

It seems only yesterday that Radio Arlington (or NAA as I know it) was the one certain wireless signal that could be received consistently and at great distances. I knew it between 1915 and 1923, first as an amateur operator and later as a commercial wireless operator on coastal and trans-Atlantic ships.

Using a galena detector, signals of NAA were received as far away as 4,000 miles, normal range of wireless stations at that time was around 500 miles. Radio Arlington was a constant dependable link with home.--Dr. Allen B. DuMont, Chairman of the Board, DuMont Laboratories, Inc.

During service as an operator on an Army transport, in the first World War I found the transmissions of NAA like a warm welcoming friend when thousands of miles from home.

I remember, in particular, feeling very homesick on a bleak black night off the west coast of Africa during the height of submarine warfare and the uplifting effect of receiving NAA's time check, weather, and news reports despite impending violence. The characteristic musical pitch of NAA will remain forever indelible in our memories.--J. R. Poppelle, Director of the Voice of America.

NAA undoubtedly has probably been heard by more operators over the half century than any other station's wireless signals. Its bell-like note was like a beacon shining in the dark to ships at sea that depended on NAA's time signals and weather reports for safe navigation.

NAA will live forever in our memories. 73 and 30 (73 means best regards and 30 means signing off.)--Veterans Wireless Operators Association, W. J. McGonigle, President, William C. Simon, General Manager.

At decommissioning ceremonies of Radio Arlington, the Arlington Chamber of Commerce announced

that Congress was being asked to establish a naval communications museum on the site.

The Chamber also presented a plaque to be erected there that will read--

*United States Navy  
Radio Station NAA, or  
"Radio Arlington"  
1913 - 1956*

*Erected in 1912 and in operation in 1913, this was the world's most powerful radio station, and the first "wireless station" in the world to be called a "radio station." To this site the U.S. Navy brought Dr. Lee De Forest, the "father of radio broadcasting," to aid in historic pioneer developments. Here, in 1913, was accomplished the first determination of longitude by radio*

*in cooperation with French scientists located in the Eiffel Tower at Paris, France. From this point, in 1915, was accomplished the first transoceanic radiotelephone system in history, followed by similar unprecedented voice messages from this point to the Hawaiian Islands. From this radio station went forth time signals by which the people of the Nation set their clocks and watches. During the World War this station also carried radio traffic of the War Department to Europe. Through this radio station, President Franklin Delano Roosevelt often maintained contact with the Nation while he was at sea. NAA, or "Radio Arlington," was the pioneer radio station of modern high-power radio age.*

*Arlington Chamber of Commerce,  
July 14, 1956.*

## NEW HUMIDITY-RESISTANT ELECTRICAL INSULATING MATERIALS

By **L. E. Sieffert**

*Plastics and Dielectrics Section,  
Bureau of Ships*

Dampness is probably the greatest natural enemy of electrical insulating materials. The Bureau of Ships has been sponsoring research to develop material that will resist the effects of dampness.

As the result of recent developments, three specifications have been prepared for new types of insulating materials that will be es-

pecially useful in electronic equipments operating under high humidity conditions.

The following specifications are the first to be written—either in Government or industry—for applying the following plastic materials as electrical insulation in electronic equipment:

1. Epoxy resin glass cloth laminated plastic sheets—type GEE of specifications MIL-P-18177A.
2. Diallyl phthalate resin-Orlon (acrylic fiber)-filled molding com-

**TABLE 1**  
**Epoxy Resin Glass Cloth Laminates**  
**Partial List of Specification Requirements**

Dielectric breakdown parallel to laminations, s/s	48 hours in water at 50° C.	30.0 kv.
Dielectric constant at 1 mc.	"	5.8
Dissipation factor at 1 mc.	"	0.045
Volume resistivity	96 hours at 35° C. and 90% humidity	100,000 megohm-cm.
Surface resistance	"	1,000 megohms
Flexural strength, lengthwise	As received	50,000 p.s.i.